



# UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 2105.2050

First Named Inventor or Application Identifier

WILLIAM MUTILANGI, ET AL.

Express Mail Label No.

## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

## ADDRESS TO:

Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 20231

1. ☐ Fee Transmittal Form  
(Submit an original, and a duplicate for fee processing)

2. ☒ Specification Total Pages 11

3. ☐ Drawing(s) (35 USC 113) Total Sheets

4. ☒ Oath or Declaration Total Pages 2

a. ☒ Newly executed (original or copy)

b. ☐ Unexecuted for information purposes

c. ☐ Copy from a prior application (37 CFR 1.63(d))  
(for continuation/divisional with Box 17 completed)  
[Note Box 5 below]

i. ☐ DELETION OF INVENTOR(S)

Signed Statement attached deleting inventor(s)  
named in the prior application, see 37 CFR  
1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference (useable if Box 4c is checked)  
The entire disclosure of the prior application, from which a copy of the  
oath or declaration is supplied under Box 4c, is considered as being  
part of the disclosure of the accompanying application and is hereby  
incorporated by reference therein.

6. ☐ Microfiche Computer Program (Appendix)

7. Nucleotide and/or Amino Acid Sequence Submission  
(if applicable, all necessary)

a. ☐ Computer Readable Copy

b. ☐ Paper Copy (identical to computer copy)

c. ☐ Statement verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

8. ☒ Assignment Papers (cover sheet & document(s))

9. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney

10. ☐ English Translation Document (if applicable)

11. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Return Receipt Postcard (MPEP 503)  
(Should be specifically itemized)

14. ☐ Small Entity Statement(s) ☐ Statement filed in prior application  
Status still proper and desired

15. ☐ Certified Copy of Priority Document(s)  
(if foreign priority is claimed)

16. ☐ Other: \_\_\_\_\_

17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. \_\_\_\_/\_\_\_\_

## 18. CORRESPONDENCE ADDRESS

☒ Customer Number or Bar Code Label

05514

(Insert Customer No. or Attach bar code label here)

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CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
	TOTAL CLAIMS (37 CFR 1.16(c))	10-20 =	0	X \$ 18.00 =	\$000.00
	INDEPENDENT CLAIMS (37 cfr 1.16(b))	2-3 =	0	X \$ 78.00 =	\$000.00
	MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d))			\$260.00 =	\$000.00
				BASIC FEE (37 CFR 1.16(a))	\$000.00
	Total of above Calculations =				\$760.00
	Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28).				
	TOTAL =				\$760.00

19. Small entity status

- a. ☐ A Small entity statement is enclosed
- b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
- c. ☐ Is no longer claimed.

20. ☒ A check in the amount of \$ 760.00 to cover the filing fee is enclosed.

21. ☒ A check in the amount of \$ 40.00 to cover the recordal fee is enclosed.

22. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 08-1205:

- a. ☒ Fees required under 37 CFR 1.16.
- b. ☒ Fees required under 37 CFR 1.17.
- c. ☐ Fees required under 37 CFR 1.18.

**SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED**

NAME Elizabeth F. Holowacz

SIGNATURE

*Elizabeth F. Holowacz*

DATE

December 9, 1999

EFH:meg

NY\_MAIN 46887 v 1

- 1 -

## TITLE

USE OF METAL SALTS TO IMPROVE THE TASTE OF LOW-CALORIE  
BEVERAGES SWEETENED WITH SUCRALOSE

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## BACKGROUND OF THE INVENTION

## Field of the Invention

- 10 This invention relates to low-calorie beverage  
compositions comprising sucralose, acesulfame-K,  
calcium phosphate, calcium sulfate and potassium  
sulfate. This invention also relates to methods of  
improving the taste attributes of low-calorie beverages  
15 by incorporating sucralose, acesulfame-K, calcium  
phosphate, calcium sulfate and potassium sulfate  
therein.

## Related Background Art

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- Generally, when sugar is replaced with artificial  
sweeteners in the formulation of low-calorie beverages,  
sweetness character and other taste attributes are  
significantly altered. Compared to sugar-sweetened  
25 beverages, low-calorie beverages are typically described

as "thin in mouthfeel", lacking "up-front sweetness" and exhibiting a "metallic, bitter, and lingering sweet aftertaste". These attributes are often used to describe the "diet" taste profile of low-calorie beverages. Currently, no single artificial sweetener delivers the sensory properties of sugar.

It is known that low-calorie beverages containing blends of artificial sweeteners have less "diet" taste than those formulated with a single sweetener. While blending helps to improve the taste profile of artificial sweeteners, this alone is not sufficient to bridge the taste gap between low-calorie and full-calorie beverages.

German Patent DE 33 31 517 broadly relates to acesulfame-containing preparations with improved taste. While combination with other sweeteners is contemplated therein, the patent is directed to the use of acesulfame-K as the primary sweetener; there is no disclosure related to sucralose. The patent discloses the use of soluble salts of inorganic acids, including calcium phosphate, calcium sulfate and potassium sulfate, in combination with acesulfame-K compositions in order to make the "taste better" and to obtain products "superior in taste". The patent also discloses the use of a mixture of salts of inorganic acids. The German patent enumerates a long list of possible additives for acesulfame-K compositions, giving no guidance with respect to what additives will work best or what effects can be achieved. The only calcium and potassium salts exemplified by the German patent are tricalcium phosphate and potassium polyphosphate, and those salts are not exemplified in combination with one another.

## SUMMARY OF THE INVENTION

The present invention is directed to low-calorie compositions comprising sucralose and acesulfame-K  
5 sweeteners and calcium phosphate, calcium sulfate and potassium sulfate metal salts.

This invention is also directed to a method of improving the taste attributes of a low-calorie beverage by  
10 incorporating into the beverage a blend of sweeteners comprising sucralose and acesulfame-K and a blend of metal salts comprising calcium phosphate, calcium sulfate and potassium sulfate.

## 15 DETAILED DESCRIPTION

According to the present invention, a selected blend of metal salts modifies the overall sweetness, aftertaste duration, mouthfeel and sucrose-like quality of low-  
20 calorie beverages sweetened with a blend of sucralose and acesulfame-K. This taste modification brings the profile closer to the taste of a sugar-sweetened beverage and makes the blend of sucralose and acesulfame-K a potentially effective sweetener system  
25 for low-calorie beverages.

Three salts that individually improved the sweetness profile of a blend of sucralose and acesulfame-K were identified and subsequently blended for maximum synergy  
30 to optimize their effects. The mixture of salts having maximal positive impact on sweetness quality consists of calcium phosphate, calcium sulfate and potassium sulfate.

Without being bound to theory, divalent cations such as calcium are believed to influence sweetness receptors located on the tongue surface and subsequently the subcellular ion channels. Other salts such as potassium  
5 salts may bind onto the bitter receptors, thus promoting cleaner sweetness response.

Thus, one embodiment of the present invention is directed to low-calorie beverage compositions comprising  
10 sucralose and acesulfame-K sweeteners and calcium phosphate, calcium sulfate and potassium sulfate metal salts. As used herein, the term "low-calorie beverage composition" refers to cola, orange, lemon, lime, root beer and other flavored beverage compositions in which  
15 sugar has been partially or completely replaced with one or more artificial sweeteners.

Sucralose (1,6-dichloro-1,6-dideoxy-beta-D-fructofuranosyl-4-chloro-4-deoxy-alpha-D-  
20 galactopyranoside) is a known artificial sweetener. Sucralose suitable for use in the present invention may be obtained in any conventional manner.

Typically sucralose is present in the low-calorie  
25 beverage compositions of the present invention in an amount from 0.01% to about 0.03% by weight, based on finished beverage weight (about 100 to 300 ppm).

Acesulfame-K (6-methyl-1,2,3-oxathiazine-4[3H]-one 2,2-dioxide potassium salt) is a known artificial sweetener,  
30 approximately 200 times as sweet as sucrose. Acesulfame-K suitable for use in the present invention may be obtained in any conventional manner.

Typically acesulfame-K is present in the low-calorie beverage compositions of the present invention in an amount from 0.004% to about 0.008% by weight, based on finished beverage weight (about 40 to 80 ppm).

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The metal salts calcium phosphate, calcium sulfate and potassium sulfate are well known in the art and may be obtained in any conventional manner for use in the present invention.

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Typically calcium phosphate is present in the low-calorie beverage compositions of the present invention in an amount from 0.004% to about 0.03% by weight, based on finished beverage weight (about 40 to 300 ppm), while calcium sulfate is present in the low-calorie beverage compositions of the present invention in an amount from 0.0002% to about 0.004% by weight (about 2 to 40 ppm), based on finished beverage weight. Generally potassium sulfate is present in the low-calorie beverage compositions of the present invention in an amount from 0.0002% to about 0.004% by weight (about 2 to 40 ppm), based on finished beverage weight.

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The mixture of salts having maximal positive impact on sweetness quality consists of calcium phosphate (80%), calcium sulfate (10%) and potassium sulfate (10%). Such a blend provides improvement of overall sweetness, while reducing sweetness linger and increasing mouthfeel and sucrose quality.

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When a blend of metal salts according to the present invention is used at 180 +/- 10 ppm in low-calorie beverage compositions containing blends of sucralose and acesulfame-K, the taste profile of the formulation is maximally positively impacted. Significantly higher use

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levels of the selected salts yield an undesirable salty taste, while significantly lower levels provide no significant taste modification benefit.

- 5 All of the above concentration ranges are based upon finished beverage weight. A finished beverage, according to the present invention, may comprise any conventional beverage ingredient, in addition to the sucralose, acesulfame-K and metal salt blend. Such
- 10 beverage ingredients include, without limitation, flavors, acids, colors, water, buffers, and preservatives. Amounts of such ingredients will vary depending upon the type of beverage.
- 15 The present invention is also directed to a method of improving the taste attributes of a low-calorie beverage by incorporating into the beverage sucralose and acesulfame-K sweeteners and calcium phosphate, calcium sulfate and potassium sulfate metal salts. In
- 20 particular, overall sweetness intensity is improved, aftertaste duration is decreased, mouthfeel is increased and sucrose quality is increased.

The Examples which follow are intended as an

25 illustration of certain preferred embodiments of the invention, and no limitation of the invention is implied.

#### EXAMPLE 1

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A low-calorie cola beverage, sweetened with a blend of 225 ppm sucralose and 70 ppm acesulfame-K, was prepared by combining the following: 1.03 g sodium benzoate, 3.49 g acidulant, 5.40 g sucralose, 0.42 g acesulfame-K

35 and 13.70 g cola flavor. The syrup was diluted with



carbonated water at a ratio of one part syrup to five parts carbonated water to obtain a beverage characterized by pH 2.7 and titratable acidity of 12.0. To this beverage, calcium phosphate (0.86 g), calcium sulfate (0.11 g) and potassium sulfate (0.11 g) metal salts were added to deliver 144 ppm, 18 ppm and 18 ppm, respectively, in the finished beverage.

#### COMPARATIVE EXAMPLE 1

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A low-calorie cola beverage, sweetened with a blend of 225 ppm sucralose and 70 ppm acesulfame-K, was prepared by combining the following: 1.03 g sodium benzoate, 3.49 g acidulant, 5.40 g sucralose, 0.42 g acesulfame-K and 13.70 g cola flavor. The syrup was diluted with carbonated water at a ratio of one part syrup to five parts carbonated water to obtain a finished beverage characterized by pH 2.7 and titratable acidity of 12.0.

#### 20 Taste Testing

Beverages made according to Example 1 and Comparative Example 1 were aged at 90°F for 3 days prior to tasting to allow for flavor equilibration. Sample evaluation was conducted using six expert panelists trained on the sweetness characteristics of sucralose. Evaluation was done by rating the samples on ballots in which the control sample was anchored in the middle of a six point line scale for each attribute. Attributes rated were overall sweetness intensity, aftertaste duration, cola flavor strength, mouthfeel and sucrose quality. All beverages were tasted at room temperature.

The mean scores for the sample containing the optimized salt blend (Example 1) are shown in Table 1 below:

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Table 1.

attribute	score
overall sweetness intensity	+2
aftertaste duration	-2
cola flavor strength	0
mouthfeel	+1
sucrose quality	+2

\*A score of +/- 1 for an attribute is considered significantly different from the control.

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As the results show, use of the optimized salt blend increased overall sweetness, mouthfeel, and sucrose quality while reducing aftertaste duration.

- 15 Other variations and modifications of this invention will be obvious to those skilled in this art. This invention is not to be limited except as set forth in the following claims.

What is claimed is:

1. A low-calorie beverage composition comprising sucralose and acesulfame-K sweeteners and calcium phosphate, calcium sulfate and potassium sulfate metal salts.
2. The composition according to claim 1, comprising about 0.01 to about 0.03% by weight sucralose and about 0.004 to about 0.008% by weight acesulfame-K, based on finished beverage weight.
3. The composition according to claim 1, comprising about 0.004 to about 0.03% by weight calcium phosphate, about 0.0002 to about 0.004% by weight calcium sulfate and about 0.0002 to about 0.004% by weight potassium sulfate, based on finished beverage weight.
4. A method of improving the taste attributes of a low-calorie beverage by incorporating into the beverage sucralose and acesulfame-K sweeteners and calcium phosphate, calcium sulfate and potassium sulfate metal salts.
5. The method according to claim 4, comprising about 0.01 to about 0.03% by weight sucralose and about 0.004 to about 0.008% by weight acesulfame-K, based on finished beverage weight.
6. The method according to claim 4, comprising about 0.004 to about 0.03% by weight calcium phosphate, about 0.0002 to about 0.004% by weight calcium sulfate and about 0.0002 to about 0.004% by weight potassium sulfate, based on finished beverage weight.

7. The method according to claim 4, wherein the improved taste attribute is overall sweetness intensity.

8. The method according to claim 4, wherein the improved taste attribute is aftertaste duration.

9. The method according to claim 4, wherein the improved taste attribute is mouthfeel.

10. The method according to claim 4, wherein the improved taste attribute is sucrose quality.

11. The method according to claim 4, wherein the improved taste attribute is mouthfeel.

ABSTRACT

Low-calorie beverage compositions comprising sucralose, acesulfame-K, calcium phosphate, calcium sulfate and potassium sulfate are disclosed. Methods of improving the taste attributes of low-calorie beverages by incorporating sucralose, acesulfame-K, calcium phosphate, calcium sulfate and potassium sulfate therein are also disclosed.

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COMBINED DECLARATION AND POWER OF ATTORNEY  
FOR PATENT APPLICATION  
(Page 1)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled USE OF METAL SALTS TO IMPROVE THE TASTE OF LOW-CALORIE BEVERAGES SWEETENED WITH SUCRALOSE

the specification of which ☒ is attached hereto ☐ was filed on \_\_\_\_\_ as United States Application No. or PCT International Application No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b), of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designates at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed:

Country	Application No.	Filed (Day/Mo./Yr.)	(Yes/No) Priority Claimed
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I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Application No.	Filed (Day/Mo./Yr.)	Status (Patented, Pending, Abandoned)
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I hereby appoint the practitioners associated with the firm and Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to the address associated with that Customer Number:

**FITZPATRICK, CELLA, HARPER & SCINTO**  
Customer Number: 05514

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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COMBINED DECLARATION AND POWER OF ATTORNEY  
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